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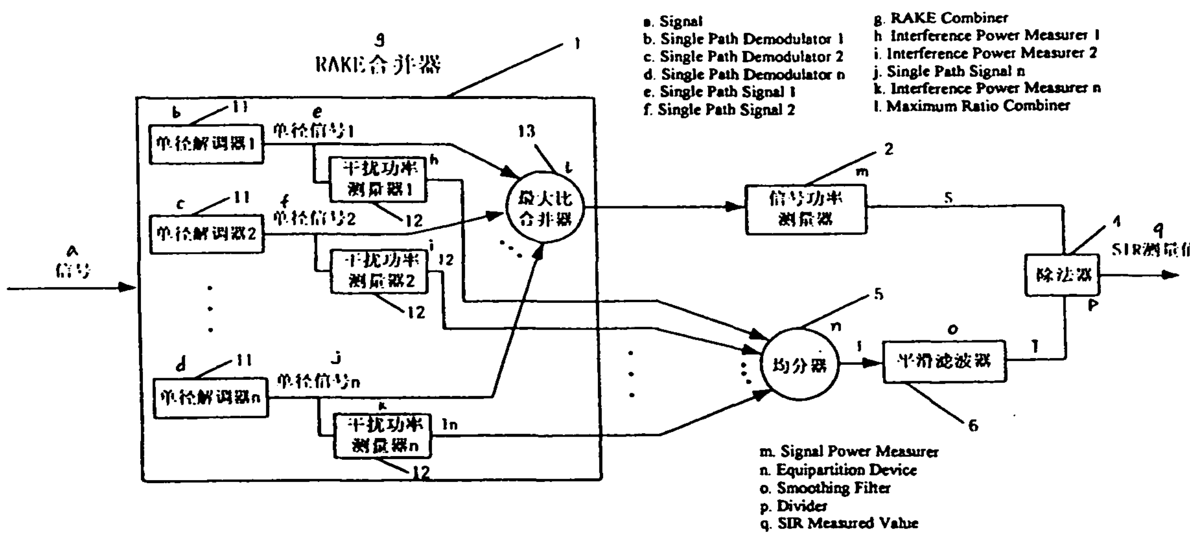
本国际公布:
— 包括国际检索报告。

所引用双字母代码和其它缩写符号，请参考刊登在每期PCT公报期刊起始的"代码及缩写符号简要说明"。

(54) Title: SIR MEASURE METHOD AND APPARATUS FOR THE SAME

(54) 发明名称: 信号干扰比的测量方法及装置



(57) Abstract: Present invention discloses a SIR measure method for CDMA mobile communication system. This method comprise of: to measure interference power (I) of single path signals after demodulating in single path in multipath receiving means of receiving terminal, making equipartition and combine for the measured result of interference power to obtain total interference power value; measuring signal power(S) after maximum ratio combine for each single path signal, and obtaining its SIR by division operation. Apparatus carried out above mentioned method is to place measure means of interference power into the RAKE combiner, and place measure means of signal power behind the RAKE combiner, thereby can provide effective information for more interference measure amount, and more really reflect channel's change.

WO 02/17531 A1

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(57) 摘要

本发明公开了一种应用于码分多址移动通信系统的信号干扰比测量方法，为在接收端多径接收装置的单径解调后测量该单径信号的干扰功率（I），将各单径信号的干扰功率测量结果经均分合并得到总干扰功率值；在各个单径信号经最大比合并后测量其信号功率（S），经除法运算得到该信号干扰比。本发明实现上述方法的装置是将干扰功率的测量装置放到RAKE合并器中，而信号功率的测量装置放到RAKE合并器后，可以提供干扰测量更多的有效信息，更加真实地反映信道的变化。

信号干扰比的测量方法及装置

技术领域

本发明涉及码分多址移动通信技术领域，特别涉及在接收端进行的一种信号干扰比（SIR）的测量方法及装置。

发明背景

SIR 测量技术是码分多址移动通信系统中的关键技术，主要应用于功率控制、软切换和小区搜索等方面，为系统正常运行提供适时有效的信干比信息。SIR 测量的准确与否将直接影响移动通信系统的性能。传统的 SIR 测量过程可参考“SIR_Based Transmit Power Control of Reverse Link for Coherent DS-CDMA Mobile Radio”（IEICE TRANS. COMMUN. VOL.E81-B，NO.7 JULY 1998），并对照图 1 所示，其 SIR 的测量过程可简略归纳如下：

1）传输的多径信号经过 RAKE 接收机中的 RAKE 合并器 1 后，形成单路信号。

2）RAKE 合并后的信号一路经过信号功率测量器 2 用于信号功率的估测，另一路经过干扰功率测量器 3 用于干扰功率的估测。具体的估测公式亦可参照上述参考文献。

3）将信号功率测量器 2 和干扰功率测量器 3 的输出值通过除法器 4 做除法运算，即可得到 SIR 的测量值。

由于信号的传输为多径传输，并在接收端采用多径接收技术，而传统的 SIR 测量方法是对接收端 RAKE 合并之后的单路信号进行 SIR 的测量，会产生干扰测量结果的不真实、部分干扰结果损失掉等情形。再者，由于在移动通信系统中信道为瑞利衰落信道，当信道处于深衰落时这种

SIR 的测量方法就不能真实地反映信道的变化，从而不能向系统提供准确、有效的信息。

发明内容

本发明提供一种信号干扰比（SIR）的测量方法及其实现该方法的一种 SIR 测量装置，其可提供干扰测量更多的有效信息，使 SIR 的测量更为精确，为系统的正常运行提供更为准确、有效的信息。

本发明一种应用于码分多址移动通信系统的信号干扰比测量方法，为在接收端 RAKE 合并器的单径解调后测量该单径信号的干扰功率(I)，将各个单径信号的干扰功率测量结果经均分合并得到总的干扰功率值；在各个单径信号经分集合并后测量其信号功率（S）；以测得的信号功率值除以所述总干扰功率值，得到该信号干扰比。

根据上述技术方案，进一步的，可对所述的均分合并所得的总干扰功率值作平滑处理以精确该干扰功率值及信号干扰比。

上述的在接收端单径解调后测量该单径信号的干扰功率为在每一径中分别进行。上述的分集合并可为最大比值合并或等增益合并。

本发明提供实现上述方法的一种信号干扰比测量装置，至少包括 RAKE 合并器、信号功率测量器、干扰功率测量器及除法器，其中所述的 RAKE 合并器包括复数的单径解调器和一分集合并器，该等单径解调器输出的单径信号均送入分集合并器作多径信号分集合并，合并后的单路信号送入信号功率测量器作信号功率测量；所述的干扰功率测量器为复数个且置于 RAKE 合并器中，每一干扰功率测量器的输入连接于一单径解调器的输出，各干扰功率测量器测得的干扰功率输出均送入一均分器作均分合并，将合并后的输出与信号功率测量器的输出送入所述的除法器作除法运算得到信号干扰比值。

根据上述技术方案，进一步在所述的均分器的输出连接一平滑滤波器，均分器均分合并后的输出送入该平滑滤波器作平滑处理后再送入除法器与所述信号功率器的输出作除法运算得到信号干扰比值。

所述的复数个干扰功率测量器与复数个单径解调器为一一对应设置，即一单径解调器的输出端均连接有一干扰功率测量器。

所述的分集合并器可以是最大比合并器或等增益合并器。

本发明是将信号功率（S）和干扰功率（I）的测量位置分开，即在接收端的 RAKE 合并之后测量 S，在 RAKE 合并之前测量每一径的 I，然后再均分合并成总的 I，以得到 SIR 的测量。

由于本发明是将干扰功率 I 的测量放到 RAKE 合并中的每一径中分别进行，因而可以提供干扰测量更多的有效信息，使测量所得的 SIR 值比传统 SIR 测量方法的结果更加准确，也更加真实地反映信道的变化，为系统提供更加准确、有效的信息。

另外，将本发明应用到功率控制系统中，不需要修改现有功率控制的实现模块，保留了现有功率控制技术的所有优点。

附图简要说明

图 1 为现有技术 SIR 测量示意框图。

图 2 为本发明较佳实施例示意框图。

图 3 为基站发射功率概率密度图。

图 4 为基站发射功率概率分布。

实施本发明的方式

下面结合附图对本发明进行详细描述。

首先，请参见图 2 所示，发明一较佳实施例示意框图，具体的执行

过程说明如下:

1）接收端多径接收装置接收的传输信号经 RAKE 合并器 1 内的单径解调器 11 后形成各径的解调单径信号。

2)各径的解调单径信号一路通过最大比合并器 13 合成最终的信号;另一路通过干扰功率测量器 12 进行干扰功率估测，干扰功率测量公式为:

$$I_i(K)=\frac{1}{N_{pilot}}\sum_{m=0}^{N_{pilot}-1}\left|r_i(m,k)\right|^2-\left[\frac{1}{N_{pilot}}\sum_{m=0}^{N_{pilot}-1}\left|r_i(m,k)\right|\right]^2 \qquad (1)$$

其中，$I_i(k)$为第 i 个径的噪声干扰功率，$I = 1\cdots n$; n 为多径个数; N_{pilot} 为一帧数据中的导频符号的个数; $r_i(m,k)$为在第 i 个径上，第 k 个时隙中，第 m 个符号的幅度值。

3）将测得的每一径的干扰功率通过均分器 5 取平均，从而得到总的干扰功率值$\hat{I}$，即:

$$\hat{I}(k)=\frac{1}{n}\sum_{i=1}^{n}I_i(k) \qquad (2)$$

4)将均分器 5 的输出值通过一个平滑滤波器 6，以平滑干扰功率值，平滑滤波器的功能函数为:

$$\bar{I}(k)=\alpha\bar{I}(k-1)+(1-\alpha)\hat{I}(k) \qquad (3)$$

其中，$\bar{I}(k)$为经过α滤波器处理的第 k 个时隙干扰功率值，$\hat{I}(k)$为第 k 个时隙测量的干扰功率值，α为α滤波器的回归因子。在瑞利信道环境中，由于多径干扰和多用户干扰的影响，回归因子的取值不应太大。

5）对信号功率的测量仍采用常规的方法，即在 RAKE 合并之后进行测量，测量公式为:

$$S(k)=\left[\frac{1}{N_{pilot}}\sum_{m=0}^{N_{pilot}-1}\left|r(m,k)\right|\right]^2 \qquad (4)$$

6）将信号功率测量器 2 和平滑滤波器 6 的输出值通过除法器 4，即可得到第 k 个时隙的 SIR 值，即：

$$SIR(k)=\frac{S(k)}{\bar{I}(k)} \tag{5}$$

以除法器 4 的输出值作为实际的 SIR 测量值。另，如对测量结果的准确性降低要求，干扰功率测量的平滑处理可以省略。

将上述本发明技术方案应用于 WCDMA 系统中，作为内环功率控制 SIR 的测量值：在下行链路，设定导频符号数 N_{pilot} 为 4，多径数 n 为 2，接收信号的误块率（BLER）保持在 0.01。在 RAKE 合并模块中，利用公式（1）对两径中每一径的干扰功率进行测量，测量结果再利用公式（2）取平均值得到总的干扰功率值 I。信号功率 S 是通过对 RAKE 合并后的数据信号进行测量得到的。信号功率值与干扰功率值之比作为内环功率所需的 SIR 的测量值。将 SIR 测量值与外环功率控制所得到的 SIR 门限值相比较，根据比较结果得到功率控制命令，从而完成下行链路的功率控制过程。

在相同的条件下，分别采用本发明所提到的 SIR 测量方法和传统的 SIR 测量方法进行下行链路的功率控制仿真，得到如下表 1 所示的功率控制性能结果：

表 1

SIR 测量方法	单位	平均功率	一致性功率		
			50%	90%	95%
本发明所用到的方法	dB	-20.55	-22.2	-19.1	-18.1
传统的 SIR 测量方法	dB	-20.16	-22.0	-18.3	-17.2

从表中可以看出采用本发明所用的 SIR 测量方法进行功率控制所得到的平均功率和一致性功率值均低于传统的 SIR 测量方法进行功率控制

所得到的值。

附图 3 和附图 4 分别为采用本发明进行功率控制时基站发射功率的概率密度和概率分布函数图。

比较本发明与现有技术的 SIR 测量算法可以看出，在保证相同业务质量的情况下，采用本发明进行的功率控制仿真性能要优于现有技术算法的仿真性能，达到了本发明的目的。

以上所述仅为本发明的最佳实施方式，并不用以限制本发明，任何对本发明技术方案所作的等效变化、替换及改进，皆应视为包含在本发明的权利要求范围之内。

权利要求书

1、 一种应用于码分多址移动通信系统的信号干扰比测量方法，其特征于该方法至少包括:

在接收端多径接收装置的单径解调后测量该单径信号的干扰功率;

将各路单径信号的干扰功率测量结果经均分合并得到总的干扰功率值;

在各路单径信号经分集合并后测量其信号功率;

以测得的信号功率值除以所述总干扰功率值，得到该信号干扰比。

2、 根据权利要求 1 所述的方法，其特征于进一步包括：将所述的经均分合并所得的总干扰功率值进一步进行平滑处理。

3、 根据权利要求 1 或 2 所述的方法，其特征于：所述的在接收端单径解调后测量该单径信号的干扰功率为在每一径中分别进行。

4、 根据权利要求 1 或 2 所述的方法，其特征于：所述的分集合并为最大比值合并或等增益合并。

5、 一种实现权利要求 1 所述方法的信号干扰比测量装置，该装置至少包括 RAKE 合并器、信号功率测量器、干扰功率测量器及除法器，其中所述的 RAKE 合并器包括复数的单径解调器和一分集合并器，其特征在于：所述的复数的单径解调器输出的单径信号均送入分集合并器作多径信号分集合并，合并后的单路信号送入信号功率测量器作信号功率测量；所述的干扰功率测量器为复数个且置于 RAKE 合并器中，每一干扰功率测量器的输入连接于一单径解调器的输出，各干扰功率测量器测得的干扰功率输出均送入一均分器作均分合并，将合并后的输出与信号功率测量器的输出送入所述的除法器作除法运算得到信号干扰比值。

6、 根据权利要求 5 所述的信号干扰比测量装置，其特征在于:

所述的均分器的输出连接有一平滑滤波器，均分器均分合并后的输出送入该平滑滤波器作平滑处理后再送入除法器与所述信号功率器的输出作除法运算得到信号干扰比值。

7、 根据权利要求 5 或 6 所述的信号干扰比测量装置，其特征在于：所述的复数个干扰功率测量器与复数个单径解调器为一一对应设置，即一单径解调器的输出端均连接有一干扰功率测量器。

8、 根据权利要求 5 所述的信号干扰比测量装置，其特征在于：所述的分集合并器为最大比合并器或等增益合并器。

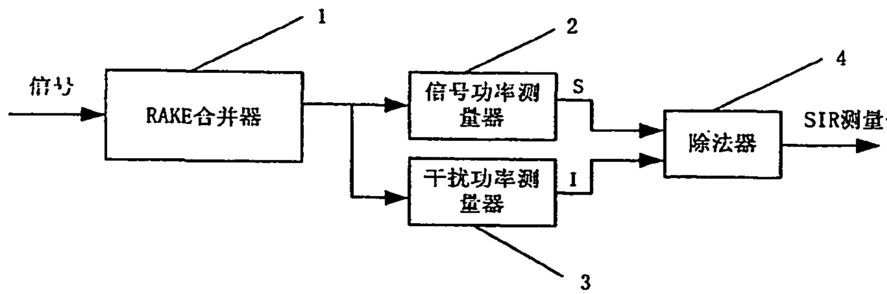

图 1

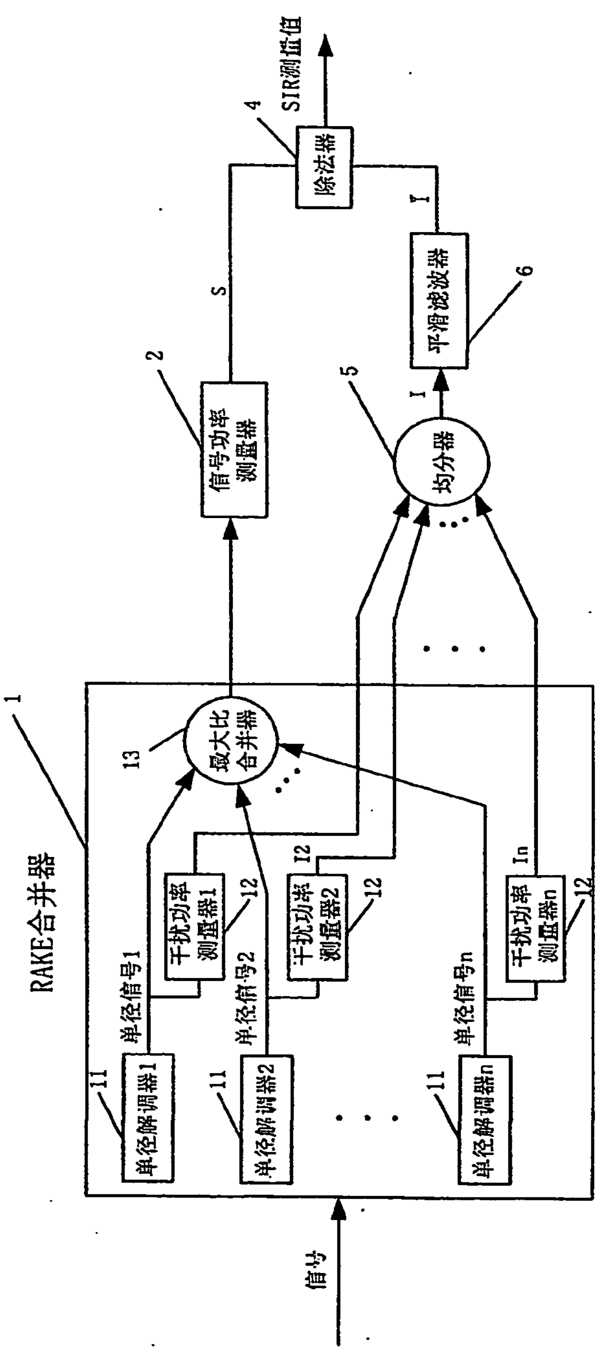
SIR测量值
4
除法器
S
I
2
信号功率测量器
6
平滑滤波器
5
均分器
I
1
RAKE合并器
13
最大比合并器
单径解调器1
单径解调器2
单径解调器n
11
单径信号1
单径信号2
单径信号n
干扰功率测量器1
干扰功率测量器2
干扰功率测量器n
12
I2
In
信号

图 2

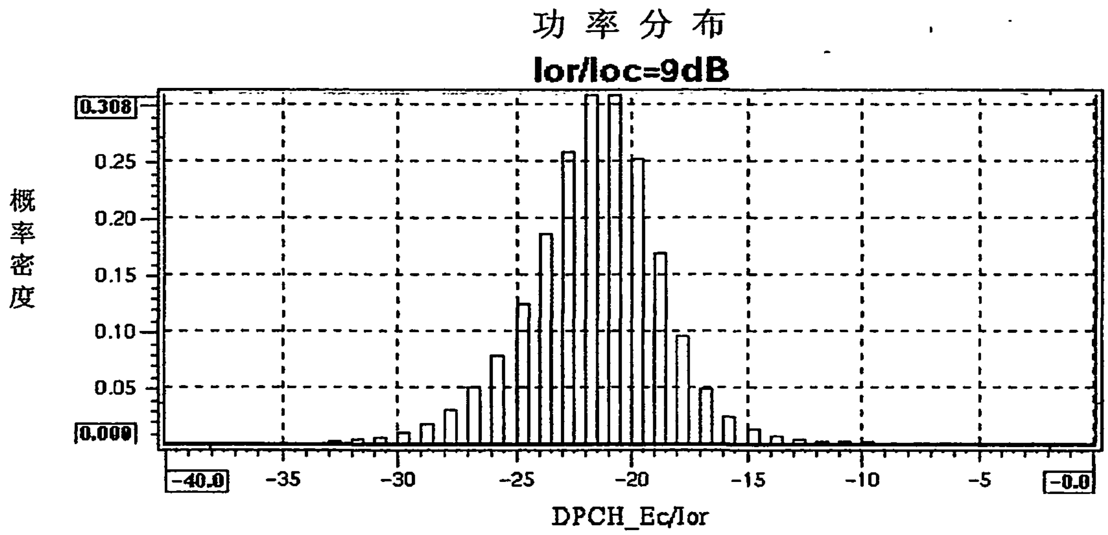

图 3

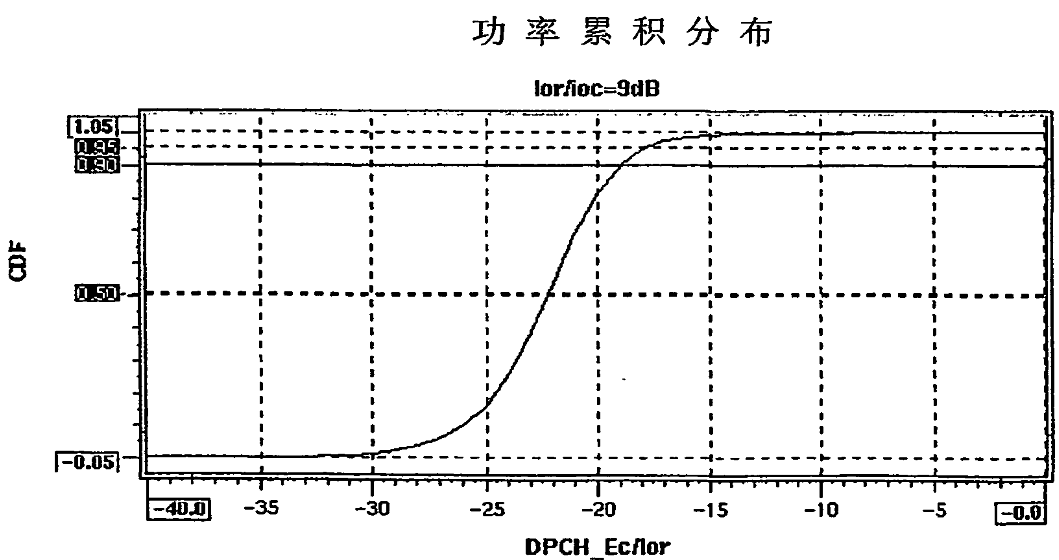

图 4

替换页(细则第26条)

INTERNATIONAL SEARCH REPORT	International application No. PCT/CN01/00807

A. CLASSIFICATION OF SUBJECT MATTER

IPC[7]: H04J13/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[7]: H04J13/00, H04B7/005, H04L1/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

SIR, measure, path, CDMA, signal, interference, ratio

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US6034952A(NTT MOBILE COMMUNICATIONS NETWORK INC) 07.Mar 2000 (07.03.00) See column3-10. abstract	1-8
A	EP0863618A2(FUJITSU LTD) 09 Sep1998(09.09.98) See page4-5,abstract	1-8
A	EP0944201A2(LUCENT TECHNOLOGIES INC)22. Sep 1998(22.09..99) See page3-4, abstract	1-8

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 Sep 2001(11.09.01)	25 OCT 2001 (25.10.01)
Name and mailing address of the ISA/CN 6 Xitucheng Rd., Jimen Bridge, Haidian District, 100088 Beijing, China Facsimile No. 86-10-62019451	Authorized officer QIN LIJUN Telephone No. 86-10-62093810

Form PCT/ISA /210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN01/00807

Patent document Cited in search report	Publication Date	Patent family member(s)	Publication Date
US6034952A	07.03.00	CN1193430A	16.09. 98
		EP0833472A1	01.04. 98
EP0863618A2	09.09.98	CN1194518A	30.09. 98
		US6032026A	29.02. 00
EP0944201A2	22.09.99	CN1237074A	01.12. 99
		JP11313040A	09.11.99

国际检索报告	国际申请号 PCT/CN01/00807

A. 主题的分类

IPC^7：H04J13/00

按照国际专利分类表(IPC)或者同时按照国家分类和 IPC 两种分类

B. 检索领域

检索的最低限度文献(标明分类体系和分类号)

IPC^7：H04J13/00，H04B7/005， H04L1/20

包含在检索领域中的除最低限度文献以外的检索文献

在国际检索时查阅的电子数据库(数据库的名称和，如果实际可行的，使用的检索词)

SIR, measure, path, CDMA, signal, interference, ratio

C. 相关文件

类 型*	引用文件，必要时，指明相关段落	相关的权利要求编号
A	US6034952A（TNN 移动通信株式会社） 07.3 月 2000（07.03.00） 说明书第 3 栏至 9 栏，文摘	1-8
A	EP0863618A2（富士通株式会社） 09.9 月 1998 年（09.09.98） 说明书第 4 至 5 页，文摘	1-8
A	EP0944201A2（朗讯科技公司） 22.9 月 1999 年（22.09.99） 说明书第 3 至 4 页，文摘	1-8

☐ 其余文件在 C 栏的续页中列出。　　☒ 见同族专利附件。

* 引用文件的专用类型：
"A" 明确叙述了被认为不是特别相关的一般现有技术的文件
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国际检索实际完成的日期 2001 年 9 月 11 日	国际检索报告邮寄日期 25.10月 2001（25.10.01）
国际检索单位名称和邮寄地址 ISA/CN 中国北京市海淀区西土城路 6 号(100088) 传真号： 86-10-62019451	受权官员 秦力军 电话号码：86-10-62093810

国际检索报告
关于同族专利成员的情报

国际申请号
PCT/CN01/00807

检索报告中引用的专利文件	公布日期	同族专利成员	公布日期
US6034952A	07.3 月 2000	CN1193430A	16.09.98
		EP0833472A1	01.04.98
EP0863618A2	09.9 月 1998	CN1194518A	30.09.98
		US6032026A	29.02.00
EP0944201A2	22.9 月 1999	CN1237074A	01.12.99
		JP11313040A	09.00.99

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(54) SIR MEASURE METHOD AND APPARATUS FOR THE SAME

(57) The invention discloses a signal-to-interference ratio (SIR) measurement method. The method measures interference power (I) of a single-path signal after the received signal is demodulated by the single-path demodulators of multipath receiving device at the receiving end. The total interference power is obtained by equipartition combining with the measured interference power of each single-path signal. The signal power (S) is obtained by measuring after maximum ratio combination of each single-path signal. The SIR of the received signal is the division of the signal power and the total interference power. An apparatus, implementing mentioned method, sets the interference power measurement-device in the RAKE combiner and the signal power measurement-device after the RAKE combiner. In this way, the interference measurement can effectively provide more information and can more really response to the channel variation.

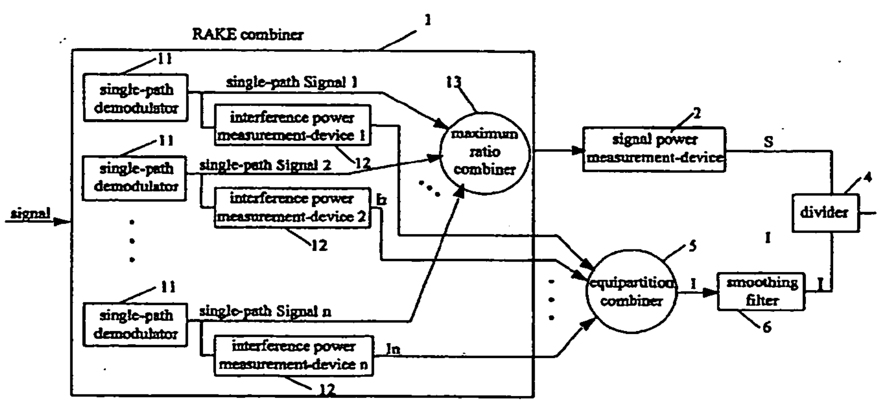

Fig. 2

EP 1 313 243 A1

Description

Field of the Technology

[0001] The present invention relates generally to CDMA mobile communication technology, and more particularly to a method and apparatus of measuring signal-to-interference ratio (SIR) at receiving end.

Background of the Invention

[0002] SIR measurement is an important technology in a CDMA mobile communication system, and is mainly used in power control, soft hand-over and cells search etc. The SIR measurement provides real time and effective signal-to-interference ratio information for normal operation of a system. Performance of a mobile communication system is directly affected by measurement accuracy of the SIR. Conventional SIR measurement can refer to article "SIR-Based Transmit Power Control of Reverse Link for Coherent DS-CDMA Mobile Radio" (IEICE TRANS. COMMUN. VOL.E81-B, NO.7 JULY 1998). With reference to Fig.1, the SIR measurement procedure can be summarized as following:

1) After passing through RAKE combiner 1 of the RAKE receiver, a transmitted multipath signal is formed a single-path signal.
2) The combined RAKE signal is sent, on the one hand, to the signal power measurement-device 2 for signal power estimate, and on the other hand, to the interference power measurement-device 3 for interference power estimate. The formulas for estimate can refer to the above document.
3) The output of the signal power measurement-device 2 and interference power measurement-device 3 is divided by the divider4 to obtain the SIR measurement value.

[0003] The conventional SIR measurement method measures SIR with the single-path signal after RAKE combining at receiving end. Nevertheless, the signal is transmitted with multipath and is received by multipath receiving technology at receiving end. Therefore, the interference measurement is unrealistic and part of the interference result is lost. Moreover, since a channel of the mobile communication system is a Rayleigh-fading channel; when the channel is at heavy fading depth, the conventional SIR measurement method cannot really reflect channel variation and cannot provide to the system accuracy and effective information.

Summary of the Invention

[0004] The invention proposes a SIR measurement method and apparatus for the same. The method and the apparatus can more effectively provide information of an interference measurement, and can make a SIR measurement more accurate.

[0005] The invention is a measurement method of signal-to-interference ratio for CDMA mobile communication system. A signal is demodulated by the single-path demodulators in the RAKE combiner of the receiving end. After that, an interference power (I) of a single-path signal is measured. The measured interference power of every single-path signal is sent to an equipartition combiner to form a total interference power. Diversity combination of every single-path signal is measured to obtain the signal power (S). By dividing the measured signal power with the total interference power, the signal-to-interference ratio is obtained.

[0006] In the technical scheme, mentioned above, said total interference power obtained by equipartition combination can be further processed with smoothing filter to make the interference power and the signal-to-interference ratio more accurate.

[0007] Said interference power measurement of a single-path signal, after having been demodulated by a single-path demodulator at the receiving end, is made in every path, respectively. Said diversity combination can be maximum ratio combination or equivalence gain combination.

[0008] The invention provides a signal-to-interference ratio measurement apparatus implementing the method, mentioned above. The apparatus at least includes a RAKE combiner, a signal power measurement-device, interference power measurement-devices and a divider.

[0009] The RAKE combiner includes multiple single-path demodulators and a diversity combiner. All single-path signals outputted from the single-path demodulators are made diversity combination of multipath signal in the diversity combiner to form a single signal, which is used for signal power measurement in the signal power measurement-device.

[0010] The interference power measurement-devices are multiple devices set in the RAKE combiner. An input of every interference power measurement-device is connected to the output of the single-path demodulator, respectively. All interference power outputs measured by every interference power measurement-device are sent to an equipartition combiner for equipartition combination. The output of the equipartition combiner and the output of the signal power

measurement-device are sent to the divider for division operation to obtain a signal-to-interference ratio.

[0011] The technical scheme mentioned above can further include a smoothing filter. The smoothing filter input is connected to the equipartition combiner output. The output of the equipartition combiner is further made smooth processing. The output of the smoothing filter and the output of the signal power measurement-device are sent to the divider to make a division operation to obtain the signal-to-interference ratio.

[0012] Said multiple interference power measurement-devices and multiple single-path demodulators are correspondingly connected one by one, i.e., the output of each single-path demodulator is connected to an interference power measurement-device. Said diversity combiner can be a maximum ratio combiner or an equivalent gain combiner.

[0013] The invention separates the measurement of a signal power (S) and the interference power (I). This means that S is measured after combining in the RAKE combiner and I of every path is measured before combining and a total I is formed by equipartition combination. In this way, a SIR is measured.

[0014] Since the invention measures interference power I at every path in the RAKE combiner, so the interference measurement can effectively obtain more information. Therefore, SIR value measured by the invention method is more accurate than by the conventional method.

[0015] In addition, when the invention is used in a power control system, all the original power control module will not be updated, so all the advantages of the conventional power control are remained.

Brief Description of the Drawings

[0016]

Fig.1 shows a diagram of the conventional SIR measurement.
Fig.2 shows an embodiment block diagram of the invention.
Fig.3 is a probability density diagram of transmitting power of a base station.
Fig.4 is a probability distribution diagram of transmitting power of a base station.

Embodiments of the Invention

[0017] The invention will be described in more detail, hereinafter, with reference to drawings.

[0018] Fig.2 is an embodiment block diagram of the invention. The specific working procedure of the embodiment is described in the following:

1. A transmitted signal, received by the multipath-receiving device at the receiving end, is demodulated by the single-path demodulators 11 in RAKE combiner 1, and then an individual-path-demodulated single-path signal is formed.
2. The individual-path-demodulated single-path signal, on the one hand, passes through the maximum ratio combiner 13 and is combined to a final signal, on the other hand, passes through interference power measurement-device 12 to make interference power estimate. The interference power measurement formula is:

$$I_i(K)=\frac{1}{N_{pilot}}\sum_{m=0}^{N_{pilot}-1}\left|r_i(m,k)\right|^2-\left[\frac{1}{N_{pilot}}\sum_{m=0}^{N_{pilot}-1}\left|r_i(m,k)\right|\right]^2 \qquad (1)$$

Wherein $I_i(k)$ is i^{th} path noise interference power, i = 1, 2 ... n, n is the multipath number; N_{pilot} is the pilot symbol number in one frame data; $r_i\ (m,k)$ is the amplitude of m^{th} symbol of k^{th} time slot of i^{th} path.

3. Taking average of measured interference power of every path through the equipartition combiner 5, the total inference power $\hat{I}$ is:

$$\hat{I}(k)=\frac{1}{n}\sum_{i=1}^{n}I_i(k) \qquad (2)$$

4. The output of equipartition combiner 5 is passed through the smoothing filter 6 to smooth the interference power, functional function of the smoothing filter is:

$$\bar{I}(k) = \alpha\bar{I}(k-1) + (1-\alpha)\hat{I}(k) \qquad (3)$$

Wherein, $\bar{I}(k)$ is the k^{th} time slot interference power processed by the α filter, $\hat{I}(k)$ is the measured interference power of k^{th} time slot, α is the regressive coefficient of the α filter. In a Rayleigh channel environment, since influence of multipath inference and multiuser interference, the regressive coefficient should not take a too large value.

5. The signal power measurement uses the conventional method, i.e., measuring after RAKE combining, the measurement formula is:

$$S(k) = \left[\frac{1}{N_{pilot}} \sum_{m=0}^{N_{pilot}-1} |r(m,k)|\right]^2 \qquad (4)$$

6. By passing the outputs of the signal power measuring device 2 and smoothing filter 6 through divider 4, the SIR value of k^{th} time slot can be obtained:

$$SIR(k) = \frac{S(k)}{\bar{I}(k)} \qquad (5)$$

[0019] The output of divider 4 is taken as the real SIR measuring value. In addition, if decreasing accurate requirement of the measuring result, then the smooth processing of the inference power measurement can be neglected.

[0020] The technical scheme, mentioned above, of the invention has been used in a WCDMA (wideband CDMA) for SIR measurement of inner-loop power control. In the down link, the pilot symbol number N_{pilot} is set to 4, the multipath number n is set to 2, and the Block Error Ratio (BLER) of received signal is kept at 0.01. In the RAKE combiner module, each path of the two paths is measured with formula (1). Then, the total interference power I is obtained by taking average of the measured results with formula (2). The signal power S is obtained by measuring the data signal after RAKE combining. The ratio of the signal power and interference power is the SIR measured value for inner-loop power. Comparing the SIR measured value and the SIR threshold-value obtained by outer-loop power control, a power control command is obtained. In this way, the power control of down link is performed.

[0021] Under the same condition, by using the SIR measurement method of the invention and the conventional SIR measurement method, respectively, a power control simulation of down link is made, and the power control performance is shown in Table 1 below.

Table 1

SIR measurement method	Unit	Average power	Consistency power		
			50%	90%	95%
Method of the invention	dB	-20.55	-22.2	-19.1	-18.1
Conventional SIR measurement method	dB	-20.16	-22.0	-18.3	-17.2

[0022] It can be seen from Table 1 that the average power and consistency power obtained by using SIR measurement method of the invention are all lower than the average power and consistency power obtained by using the conventional SIR measurement method.

[0023] Fig.3 and Fig.4 show diagrams of probability density and cumulative distribution function, respectively, of transmitting power of a base station, when making power control with the method of the invention.

[0024] Comparing the invention SIR measurement method and the conventional SIR measurement method, it can be seen that under the same service quality, the simulation performance of the invention power control is better than the simulation performance of the conventional power control. Therefore, the purpose of the invention is reached.

[0025] Above mention is only an embodiment of the invention and will not be a limit of the invention. Any equivalence change, replacement and improvement are all included in the scope of the invention Claims.

Claims

1. A signal-to-interference ratio (SIR) measurement method for a CDMA mobile communication system, comprising:

   measuring a single-path signal interference power after a received signal having been made single-path demodulation in multipath receiving device at the receiving end;
   making equipartition combining to measured interference power of single-path signals for obtaining a total interference power;
   measuring a signal power after having been made diversity combination of single-path signals;
   obtaining SIR measurement value by dividing the signal power with the total interference power.

2. The method according to Claim1, further comprising, making smooth processing for the total interference power obtained from equipartition combing.

3. The method according to Claim1 or Claim2, wherein the single-path signal interference power is measured in every path, respectively.

4. The method according to Claim1 or Claim2, wherein the diversity combination is maximum ratio combination or equivalence gain combination.

5. A SIR measurement apparatus, at least comprises a RAKE combiner, a signal power measurement-device, interference power measurement-devices and a divider; wherein the RAKE combiner comprises multiple single-path demodulators and a diversity combiner, and the apparatus is **characterized in that**:

   single-path signals of the multiple single-path demodulators output are all sent to the diversity combiner to make multipath signal diversity combination;
   a single signal, outputted from the diversity combiner, is sent to the signal power measurement-device for measuring the signal power;
   the interference power measurement-devices are multiple units and are all set in the RAKE combiner; input of every interference power measurement-device is connected to a single-path demodulator output, and measured interference power of every interference power measurement-device is sent to a equipartition combiner for equipartition combination;
   the equipartition combiner output and output of the signal power measurement-device are sent to the divider for division operation to obtain a SIR value.

6. The apparatus according to Claim5, wherein the equipartition combiner is connected with a smoothing filter; the equipartition combiner output is sent to the smoothing filter for smooth processing; after that, the smoothing filter output and output of the signal power measurement-device are sent to the divider for division operation to obtain a SIR value.

7. The apparatus according to Claim5 or Claim6, wherein the multiple interference power measurement-devices and multiple single-path demodulators are correspondingly set one by one, i.e., a single-path demodulator output is connected to input of an interference power measurement-device.

8. The apparatus according to Claim5, wherein the diversity combiner is a maximum ratio combiner or an equivalence gain combiner.

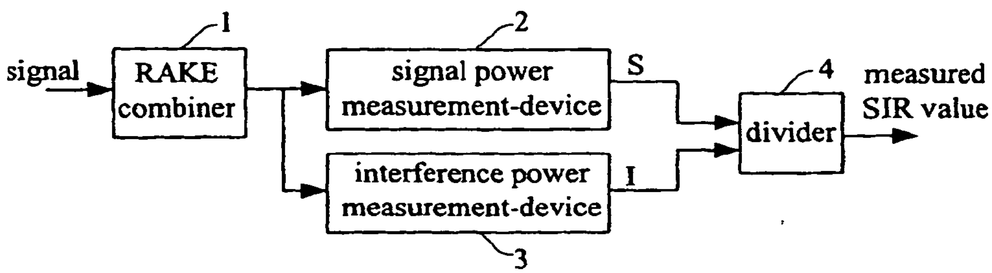
signal
RAKE combiner
1
signal power measurement-device
2
S
interference power measurement-device
3
I
divider
4
measured SIR value

Fig. 1

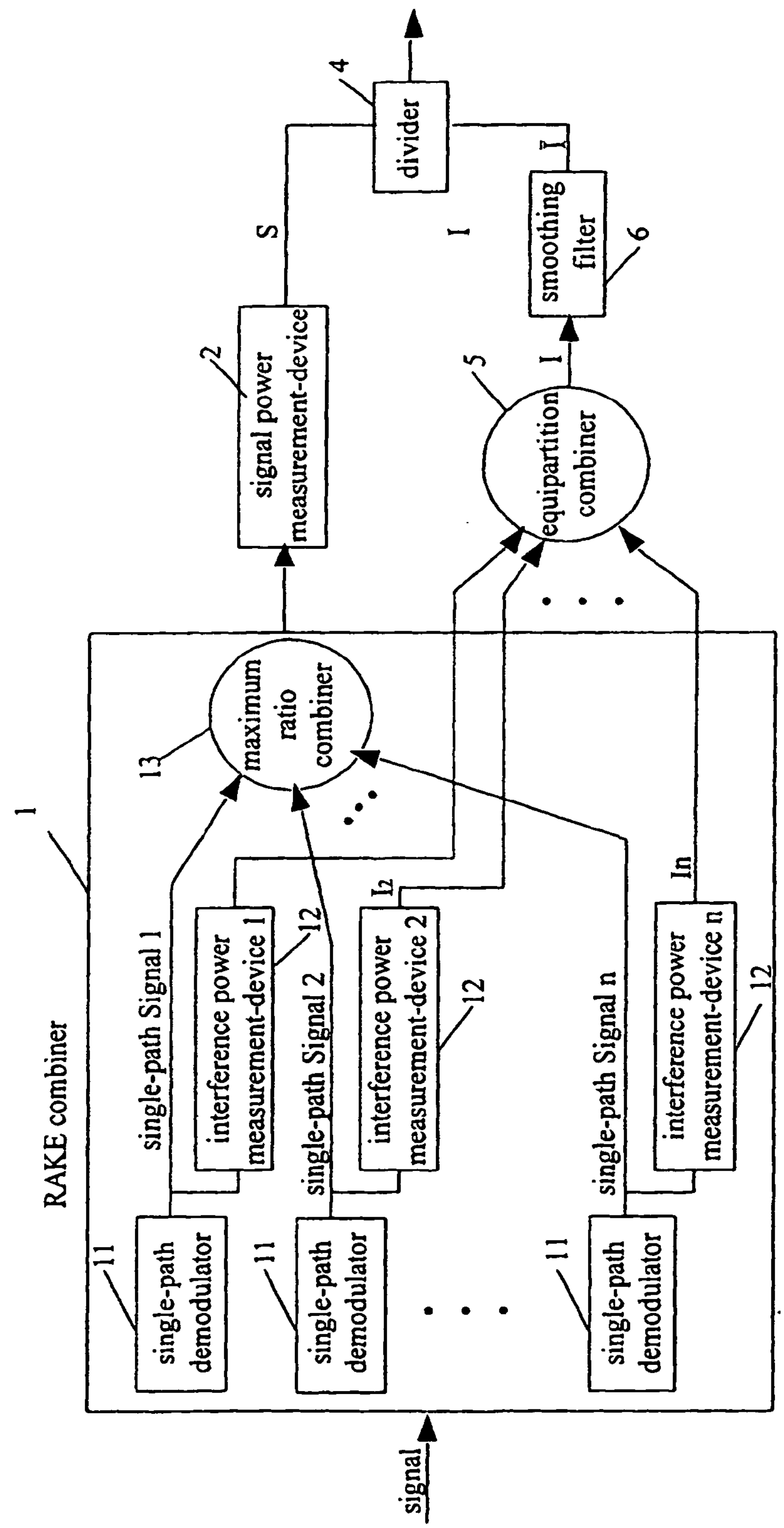
signal
RAKE combiner
1
single-path demodulator
11
single-path Signal 1
interference power measurement-device 1
12
single-path Signal 2
I2
interference power measurement-device 2
single-path Signal n
In
interference power measurement-device n
maximum ratio combiner
13
signal power measurement-device
2
S
equipartition combiner
5
I
smoothing filter
6
divider
4

Fig. 2

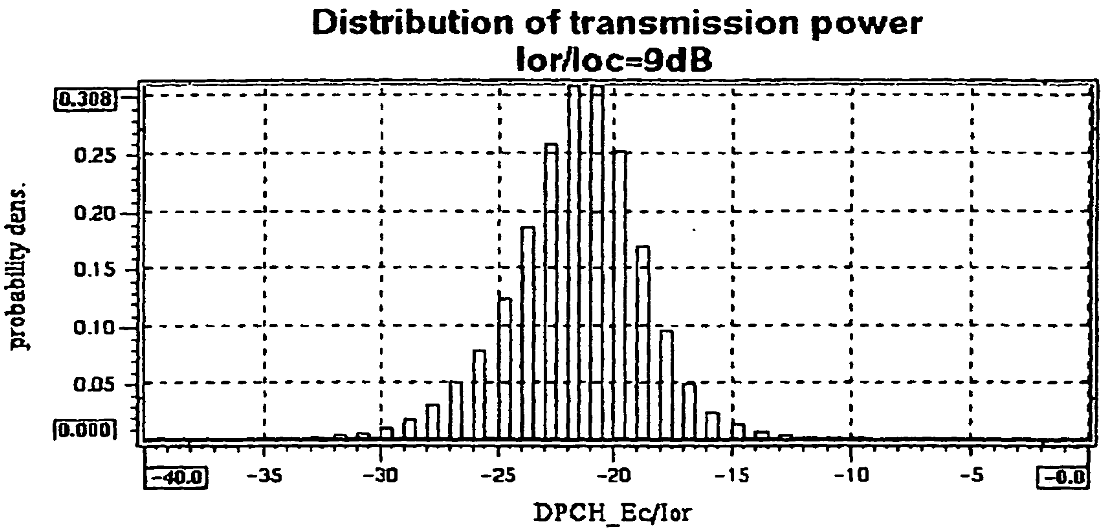
Distribution of transmission power
Ior/Ioc=9dB
probability dens.
0.308
0.25
0.20
0.15
0.10
0.05
0.000
-40.0
-35
-30
-25
-20
-15
-10
-5
-0.0
DPCH_Ec/Ior

Fig. 3

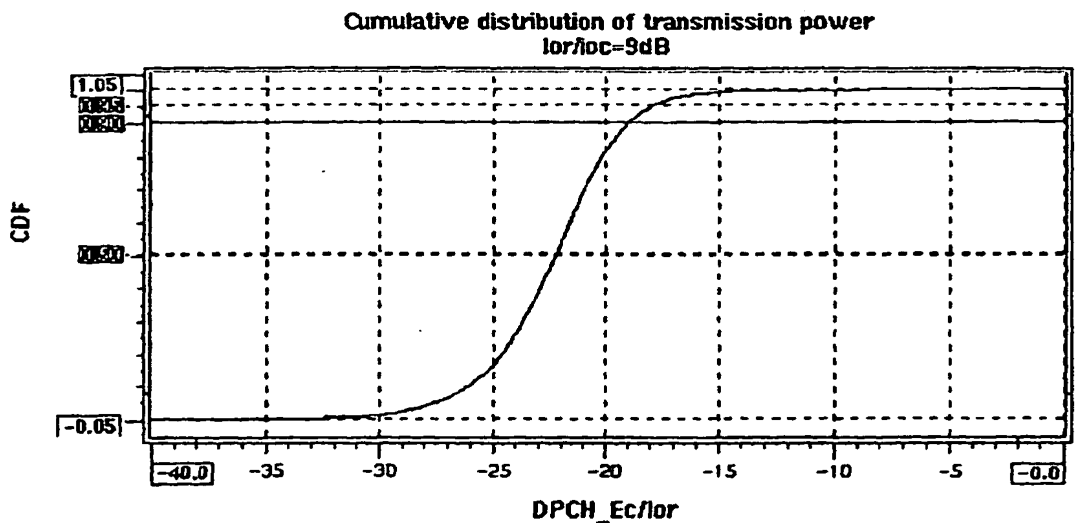
Cumulative distribution of transmission power
Ior/Ioc=9dB
CDF
1.05
-0.05
-40.0
-35
-30
-25
-20
-15
-10
-5
-0.0
DPCH_Ec/Ior

Fig. 4

INTERNATIONAL SEARCH REPORT	International application No. PCT/CN01/00807

A. CLASSIFICATION OF SUBJECT MATTER

IPC⁷: H04J13/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC⁷: H04J13/00, H04B7/005, H04L1/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

SIR, measure, path, CDMA, signal, interference, ratio

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US6034952A(NTT MOBILE COMMUNICATIONS NETWORK INC) 07.Mar 2000 (07.03.00) See column3-10. abstract	1-8
A	EP0863618A2(FUJITSU LTD) 09 Sep1998(09.09.98) See page4-5,abstract	1-8
A	EP0944201A2(LUCENT TECHNOLOGIES INC)22. Sep 1998(22.09..99) See page3-4, abstract	1-8

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 Sep 2001(11.09.01)	25 OCT 2001 (25.10.01)
Name and mailing address of the ISA/CN 6 Xitucheng Rd., Jimen Bridge, Haidian District, 100088 Beijing, China Facsimile No. 86-10-62019451	Authorized officer QIN LUJUN Telephone No. 86-10-62093810

Form PCT/ISA /210 (second sheet) (July 1998)

International application No.
PCT/CN01/00807

INTERNATIONAL SEARCH REPORT
Information on patent family members

Patent document Cited in search report	Publication Date	Patent family member(s)	Publication Date
US6034952A	07.03.00	CN1193430A	16.09.98
		EP0833472A1	01.04.98
EP0863618A2	09.09.98	CN1194518A	30.09.98
		US6032026A	29.02.00
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		JP11313040A	09.11.99

Form PCT/ISA /210 (extra sheet) (July 1998)